

Technical Requirements V5.1: Understanding Unified Glare Rating (UGR)

What is the Unified Glare Rating?

The Unified Glare Rating (UGR) predicts the glare caused by an electric lighting system along a psychometric scale of discomfort. In simpler words, UGR predicts the amount of discomfort-causing glare produced by a lighting installation for a fixed set of conditions. Discomfort glare can result in annoyance, headaches or eyestrain.

Discomfort glare is different from disability glare, which impacts the viewer's ability to discern objects accurately. **UGR is a measure of discomfort glare, not disability glare.**

UGR Fast Facts

- **UGR threshold requirements are included in European and Australian/New Zealand commercial and industrial lighting standards.**
- **The factors that affect UGR** include background luminance, average luminaire luminance and solid angle, and displacement from the line of sight.
- **UGR values generally range from 10 to 31**, where a rating of 10 indicates no perceived discomfort and a rating of 31 indicates intolerable discomfort. The DLC's UGR thresholds range from 22 to 28, based on Primary Use Designation.

Why is UGR required for DLC Premium qualification?

The DLC's goal is to support the lighting industry in improving the quality of light in the built environment and ensuring safe and comfortable work environments for people. With a UGR requirement for Premium products, lighting decision makers can select from the Premium list for better confidence in the glare performance of the products they specify or install.

Products with better glare design have the potential to:



Mitigate glare-related headaches and eyestrain



Support task performance



Promote comfort of building occupants

How does the DLC evaluate UGR?

The UGR requirements in V5.1 are only applicable to the following indoor Primary Uses applying under the Premium classification: **Troffers, Linear Ambient products, High Bays, and Low Bays.** UGR requirements are also applicable for Standard classification products (in the Primary Uses listed above) seeking an efficacy allowance for enhanced glare control.

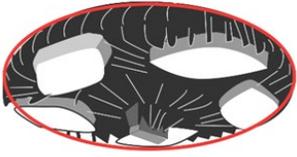
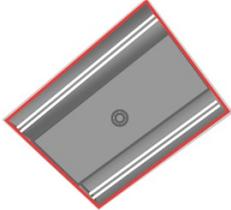
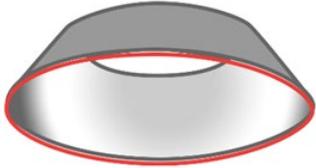
Additional information about DLC UGR evaluation:

- The DLC *does not* display calculated UGR values on the QPL. The requirement is meant to ensure that Premium products do not achieve high efficacies at the expense of increased likelihoods of discomfort glare.
- The DLC calculates UGR values using submitted tested .ies files to determine if threshold requirements for relevant Primary Use types are met. UGR values are calculated at a representative condition from the set of reference conditions described in CIE 190-2010. DLC application reviewers will use [Photometric Toolbox32](#) (Lighting Analysts, Inc., version 2.7 or newer) to verify UGR using the submitted tested .ies file.
- The product that has the highest total lumen output for each optical variation within the family (without consideration of the effect of color properties and tested at the maximum non-dimmed light output) will be used for UGR verification.
- The UGR requirement differs for each DLC Primary Use, and not all Primary Uses have a UGR requirement for qualification. These maximum permissible values already include considerations for differential luminous areas and test conditions, so no additional tolerance is allowed. See [Technical Requirements V5.1](#) for full details.
- An efficacy allowance is available under V5.1 for products in specific Primary Uses that are designed with more stringent glare control. The allowance compensates for lower efficacies that result from advanced optical designs, allowing these products to qualify either under the Standard or the Premium classification.
- UGR is undefined for linear ambient products with 100% uplight (indirect products). However, as they do not produce discomfort glare, these products will automatically meet the DLC's Premium discomfort glare requirements. In addition, these products may be eligible for other allowances if they meet the required thresholds.
- For linear ambient products with both uplight and downlight, the luminous area should encompass the luminous openings contributing to the downlight portion of the light output.
- UGR is not currently used to describe discomfort glare for outdoor products; instead, the "G" value in the prescriptive IES TM-11 BUG rating metric may be used. The DLC does not have threshold requirements for BUG at this time.

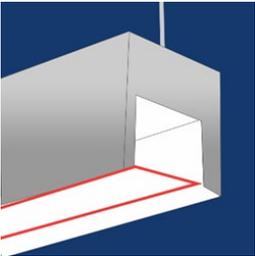
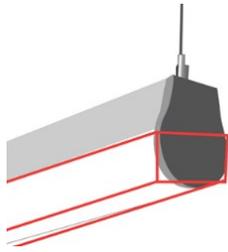
Guidance for Modeling Luminous Area

The following examples are given as guidance for modeling common types of luminaires, with luminous areas per IES LM-63. The red boundary line indicates the boundary of suggested luminous opening. Each .ies file can only have one luminous area, so the following conventions are recommended.¹

High Bay/Low Bay Luminaires

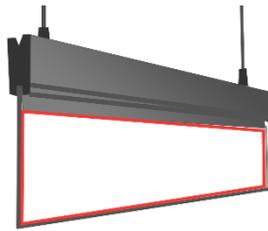
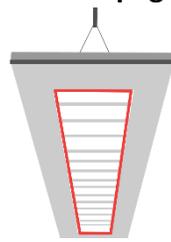
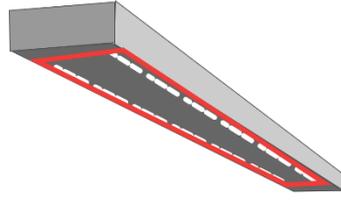
<p>Multiple LED configurations below heat sink</p> 	<p>Luminous channels on edges with opaque center</p> 	<p>Luminous disk in center with reflector/refractor</p> 
<p>Model as a circular opening encompassing all LED configurations</p>	<p>Model as rectangle (enclosing opaque area in the center) encompassing both luminous channels</p>	<p>Model as circular opening or vertical cylinder with sides encompassing all luminous components</p>

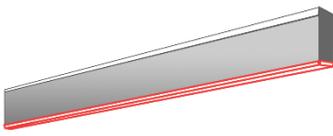
Linear Ambient Luminaires

<p>Internal channel with luminous sides and horizontal plane</p> 	<p>Cylinder with open top (uplight) and luminous panels on curved portion (downlight)</p> 	<p>Cylinder with wraparound luminous panel</p> 
<p>Model as rectangle encompassing luminous components/inset</p>	<p>If uplight only, luminaire cannot be assessed for UGR. With luminous panels, luminaire can be modeled as a rectangle with luminous sides encompassing all luminous components</p>	<p>Model as rectangle with luminous sides²</p>

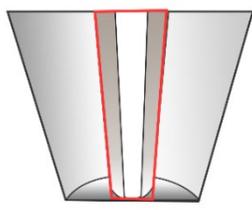
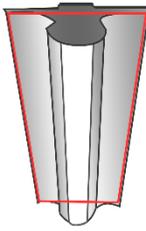
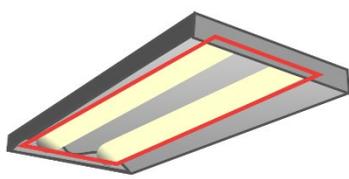
¹ IES LM-63 offers more choices for luminous openings that may also be acceptable. These recommendations are for the simplest shapes that would apply.

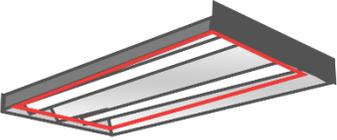
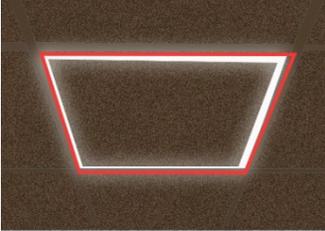
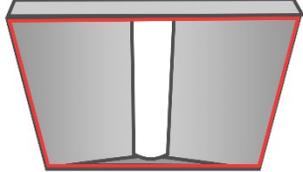
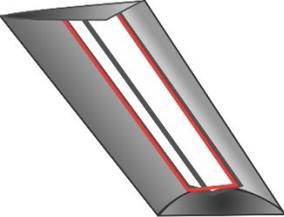
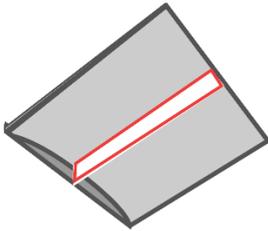
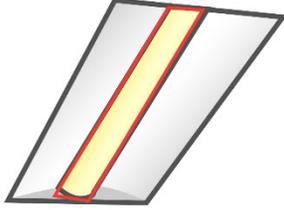
² This type of luminaire can also be modeled as a horizontal or ellipsoidal cylinder. See footnote 1.

<p>Vertical luminous panel</p> 	<p>Luminous insets with/ or without uplight</p> 	<p>Linear with bare LEDs</p> 
<p>Model as thin rectangle (e.g. 0.01 ft. width) with luminous sides</p>	<p>Model as rectangle encompassing all the luminous components/ insets</p>	<p>Model as rectangle encompassing all bare LEDs</p>

<p>Bidirectional with luminous opening on top (uplight) and bottom (downlight)</p> 
<p>If uplight only, luminaire cannot be assessed for UGR. With luminous panels, luminaire can be modeled as a rectangle with luminous sides</p>

Troffers

<p>Luminous center basket and opaque sides</p> 	<p>Luminous center basket and luminous sides</p> 	<p>Multiple luminous baskets inside luminaire with opaque center channel</p> 
<p>Model as rectangle or rectangle with luminous sides encompassing center basket</p>	<p>Model as rectangle or rectangle with luminous sides encompassing entire luminaire</p>	<p>Model as rectangle (enclosing opaque area in the center) encompassing both luminous baskets</p>

<p>Multiple luminous baskets inside luminaire</p> 	<p>Luminous surround with opaque center or no luminaire in center</p> 	<p>Luminous center panel with luminous side panels</p> 
<p>Model as rectangle or rectangle with luminous sides encompassing all luminous components</p>	<p>Model as rectangle encompassing entire luminaire</p>	<p>Model as rectangle or rectangle with luminous sides encompassing entire luminaire</p>
<p>Two luminous panels in center, separated by opaque channel</p> 	<p>Luminous wedge in center</p> 	<p>Luminous basket in center with opaque panels on each side</p> 
<p>Model as rectangle (enclosing opaque area in the center) encompassing luminous panels</p>	<p>If sides are opaque, model wedge as a thin rectangle with luminous sides. If sides are specular, model as rectangle or rectangle with luminous sides encompassing entire luminaire³</p>	<p>If sides are opaque, model center as a rectangle or rectangle with luminous sides.</p>

³ Luminous height should equal height of tallest luminous element.